Appendix G

Preliminary Geotechnical Report

DRAFT

Preliminary Geotechnical Report

Avila Community Plan Update

San Luis Obispo County, California

Yeh Project No.: 218-514

December 31, 2020

Prepared for:

Rincon Consultants, Inc.
1530 Monterey Street, Suite D
San Luis Obispo, California 93401
Attn: Ms. Lexi Journey, MESM

Prepared by:

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December 31, 2020 Project No. 218-514

Rincon Consultants, Inc.
1530 Monterey Street, Suite D
San Luis Obispo, California 93401

Attn: Ms. Lexi Journey, MESM

Subject: DRAFT **Preliminary Geotechnical Report, Avila Community Plan Update, San Luis Obispo County, California**

Dear Ms. Journey:

Yeh and Associates, Inc. is pleased to submit this preliminary geotechnical report that provides geotechnical considerations as input to preparation of the Avila Community Plan Update and Environmental Impact Report (EIR) for the area within the Avila Urban Reserve Line (URL) in San Luis Obispo County, California. This report was prepared in accordance with our subcontract agreement with Rincon dated July 10, 2020.

This evaluation consisted of a program of field reconnaissance and an evaluation of flooding, erosion, and slope instability and landslides that may result in deposition of sediment (i.e., sedimentation) within the Avila URL. This report includes a discussion of typical design measures to mitigate potential adverse drainage, erosion and sedimentation impacts from increased surface runoff and grading associated with grading for projects within the Avila URL. Graphics showing streams and watersheds, regional geology, and Natural Resources Conservation Service (NRCS) soil properties within the URL are presented on plates attached to this report. We appreciate the opportunity to be of service. Please contact Gresh Eckrich at 805-616-0399 or geckrich@yeh-eng.com if you have questions or require additional information.

Sincerely,

YEH AND ASSOCIATES, INC.	**Reviewed by:**
Gresham D. Eckrich, P.E., P.G., C.E.G. Senior Project Manager	Judd J. King, P.E., G.E. Senior Geotechnical Engineer

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1. Purpose and Scope of Study

Yeh and Associates was retained by Rincon Consultants to provide geotechnical considerations as input to preparation of the Avila Community Plan Update and Environmental Impact Report for the area within the Avila Urban Reserve Line (URL) in San Luis Obispo County, California. The location of the site is shown on Figure 1.

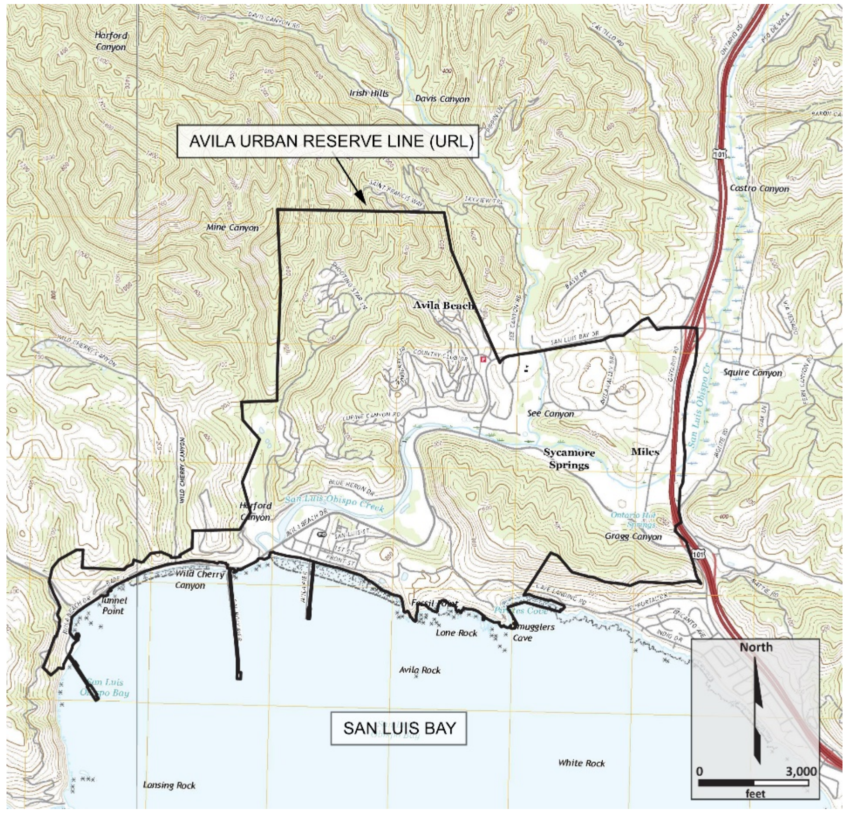

Figure 1: Project Location Map

The geotechnical evaluation consisted of a review of published maps prepared by the County of San Luis Obispo (County of SLO), United States Geological Survey (USGS), the Federal Emergency Management Agency (FEMA), and the Natural Resource Conservation Service (NRCS), and performing a site reconnaissance within the URL on November 23, 2020, to observe site conditions, review the site geology, and review evidence of erosion and sedimentation. This report includes a discussion of typical design measures to mitigate potential adverse drainage, erosion and sedimentation impacts from increased surface runoff associated with grading for projects within the URL.

2. Project Understanding

The overall project will consist of preparing an update to the Avila Community Plan and the associated Environmental Impact Report (EIR). There are approximately 2,220 acres of land within the Avila URL. Land use categories predominantly consist of residential, commercial, rural, recreational, and public facilities properties. The former Unocal property at Avila Point overlooking the Town of Avila is the only property categorized as Industrial land.

The Avila URL is accessed from Highway 101 from San Luis Bay Drive and Avila Beach Drive. San Luis Bay Drive merges into Avila Beach Drive, a two-lane road, and terminates at the parking lot at Port San Luis Harbor, near the entrance to Diablo Canyon Nuclear Power Plant. The power plant is not within the Avila URL; however, Avila Beach Drive is the main access road through the URL and serves as the main entrance to the power plant. There is no secondary access into or out of the community. Within the Avila URL, there is a port, fire station, an elementary school, five water purveyors, and one wastewater facility. The five water purveyors in the Avila URL distribute water from three sources: State Water Project, Lopez Lake Reservoir, and Avila Valley Sub- Basin.

2.1 Existing Site

The terrain in the site vicinity generally consists of the relatively flat floodplains of San Luis Obispo Creek and See Canyon Creek, and the moderately to steeply sloping hills and intervening drainages that drain towards San Luis Obispo Creek and See Canyon Creek. Plate 1 shows hillshade topographic data (PG&E 2010), the San Luis Obispo Creek watershed, sub-watersheds, and streams defined by the County of San Luis Obispo (2019a).

San Luis Obispo Creek generally flows west and southwest through the URL towards San Luis Bay. See Canyon Creek flows south until its the confluence with San Luis Obispo Creek near Sycamore Springs. Drainages at the west end of the URL are outside of the San Luis Obispo Creek watershed. Those drainages flow south to San Luis Bay through Harford Canyon, Wild Cherry Canyon, Diablo Canyon, and one unnamed canyon.

Elevations range from sea level along San Luis Bay to approximately 920 feet at the north end of the URL. Slope grades range from approximately 2 percent or less in the floodplain to approximately 60 percent in the hills.

2.2 Proposed Improvements

Proposed improvements within the Avila URL are anticipated to consist of commercial and residential development, transportation and wastewater infrastructure, and remediation of the former Unocal property at Avila Point. The following proposed improvements are listed in the Avila Community Plan Background Report (County of SLO 2018), Draft Existing Traffic Conditions Report prepared for the Avila Community Plan Update (Central Coast Transportation Consulting 2020). We understand these are relatively large-scale anticipated projects that will need to consider the potential for adverse drainage, erosion and sedimentation impacts from increased surface runoff and grading.

2.2.1 Development

Residential development within Avila Valley is clustered toward the center of the valley and not immediately adjacent to the roadways or prominent hilltops. Future development within Avila Valley is anticipated to occur on the relatively flat terrain adjacent to Avila Road, not on the hillsides (County of SLO 2018).

The San Luis Bay Estates development occupies approximately 1,050 acres in the hills located along the northwest side of the Avila URL. The development plan for San Luis Bay Estates divides development into six residential phases. The last phase of the plan is in the process of being developed along the slopes of Harford Canyon. The Harbor Terrace development is under construction and includes approximately 150 campsites, cabin/bungalow/yurt-type units, 12,000 square feet of visitor serving commercial uses, harbor uses, restrooms, and 48,000 square feet of parking. The Avila Valley Advisory Council's website (http://avac-avila.org/current-issues/) describes additional development that may occur within the URL.

2.2.2 Transportation

The following proposed transportation improvements are listed in the Draft Existing Traffic Conditions Report prepared for the Avila Community Plan Update (Central Coast Transportation Consulting 2020).

- Future vehicle, pedestrian, and vehicle access from Front Street to the Tank Farm site.
- Interchange improvements at Avila Beach Drive and Highway 101.
- Bicycle and pedestrian path between Avila Beach and Shell Beach via Cave Landing Road.
- Second Street hillside stairway to San Miguel Street.
- Class I or II bikeways on San Luis Bay Drive, Cave Landing Road from San Luis Bay Drive to Shell Beach Road at the Pismo Beach city limits. (Note: Cave Landing Road does not intersect San Luis Bay Drive.)
- Pedestrian and bicycle paths connecting harbor recreation facilities with Avila Beach, the San Luis Bay Club, and Avila Valley.
- See Canyon Road widening.

2.2.3 Wastewater

The proposed Avila Beach Community Services District Wastewater Treatment Plant Redundancy Project will include installation of a Membrane Bioreactor (MBR) treatment plant and lift station improvements. Installation of the proposed MBR unit and construction of an appurtenant retaining wall would result in a total of 1,100 cubic yards of cut/fill and a total area of disturbance of approximately 5,000 square feet. The proposed lift station improvements would result in a total of 260 cubic yards of cut/fill, and a total area of disturbance of approximately 5,100 square feet (Oliveira Environmental Consulting 2020).

2.2.4 REMEDIATION

The Avila Point project is focused on developing an approved environmental remediation plan for the former Unocal property, and may eventually result in additional development of the site for commercial purposes (https://avilapoint.com/whats-planned/).

3. GEOLOGIC SETTING

The project is located within the Coast Ranges geologic and geomorphic province, which extends from the Transverse Ranges in southern California to the Klamath Mountains in northern California and into Oregon. The province is characterized by north-northwest trending mountain ranges composed of sedimentary, volcanic, and metamorphic formations comprising predominantly Jurassic and Cretaceous age rocks with Tertiary to Quaternary age rocks and soil commonly overlying the older formations along the flanks and foothills of those ranges. Quaternary age alluvium and colluvium are found above the rock within intervening drainages, valleys, and coastal areas.

The regional geology in the site vicinity as mapped by Hall et al. (1979) and Wiegers (2011) is shown on Plate 2. Hall et al. (1979) and Wiegers (2011) mapped alluvium, landslide deposits, and six bedrock formations within the Avila URL. Plate 3 shows soil types mapped by the Natural Resources Conservation Service (NRCS). The soil types shown were classified by the NRCS according to the Unified Soil Classification System (USCS). The mapped geologic units are described further below. NRCS soil types derived from weathering of geologic units are noted where the delineated areas appear consistent between the geologic map and NRCS map.

Alluvium (Qya). Wiegers (2011) mapped alluvium within the low-lying floodplains of San Luis Obispo Creek, See Canyon Creek, and the unnamed stream that drains Harford Canyon. The alluvium is predominantly mapped as silty clayey sand (SC-SM) and lean clay (CL).

Landslide Deposits (Qls). Hall (1973) mapped a landslide at the western end of the URL, within the limits of the Harbor Terrace development. Wiegers (2011) mapped a landslide in the southeast corner of the URL, near the trail connected to Cave Landing Road.

Pismo Formation, Squire Member (Tps). Wiegers (2011) described the Squire Member of the Pismo Formation as massive, white, calcareous, fine- to medium-grained, quartzose to arkosic, silty sandstone. Soil derived from weathering of the unit predominantly consists of silty sand (SM).

Pismo Formation, Belleview Member (Tpb/Tpbc). The Belleview Member of the Pismo Formation was described by Wiegers (2011) as light gray, bedded, resistant sandstone and interbedded siltstone, diamotaceous siltstone, claystone, and silty diatomite. Soil derived from weathering of the unit predominantly consists of silty sand (SM) and lean clay (CL).

Pismo Formation, Gregg Member (Tpg/Tpgb). Wiegers (2011) described the Gregg Member of the Pismo Formation as massive, white, soft to resistant, medium-grained, buff-weathering sandstone and locally bituminous sandstone. Soil derived from weathering of the unit predominantly consists of silty sand (SM) and silty clayey sand (SC-SM).

Pismo Formation, Miguelito Member (Tpm). The Miguelito Member of the Pismo Formation was described by Wiegers (2011) as brown to buff, moderately resistant, interbedded siltstone and claystone. Soil derived from weathering of the unit predominantly consists of silty gravel (GM).

Pismo Formation, Edna Member (Tpeb). Wiegers (2011) described the Edna Member of the Pismo Formation as buff, massive, fine- to coarse-grained, bituminous sandstone.

Monterey Shale (Tmc/Tmb). The Monterey Shale was described by Wiegers (2011) as white to reddish-brown shale interbedded with resistant chert and tan to yellowish white siltstone and dolomitic claystone. Soil derived from weathering of the unit predominantly consists of silty gravel (GM).

Obispo Formation (Tot/Tor). Wiegers (2011) described the Obispo Formation as coarse-grained tuff and resistant, hard, fine-grained, zeolotized[1] tuff. Soil derived from weathering of the unit predominantly consists of fat clay (CH).

Unnamed Sedimentary Rocks (Ks)/Atascadero Formation (Kas). The unnamed sedimentary rocks were described by Hall (1979) as interbedded white, gray, tan, brown, or dark-greenish brown hard, arkosic, wacke, medium-grained sandstone and interbedded, greenish-brown or black claystone and siltstone, with locally hard, gray, altered, siliceous sandstone near Port San

[1] Zeolites are porous, framework, aluminosilicate minerals that contain significant water and exchangeable cations. Zeolites often form through the interaction of volcanic rocks and ash with alkaline groundwater.

Luis. Dibblee and Minch (2006) mapped Atascadero Formation in the same area and described the formation as light gray to light brown, highly fractured sandstone with interbedded gray, micaceous clay shale. Soil derived from weathering of the unit predominantly consists of lean clay (CL).

Franciscan Metavolcanics (KJfmv). Hall (1979) described the metavolcanic rocks as primarily metamorphosed basalt (greenstone) and diabase that is considered to be tectonic blocks on or within or below Franciscan mélange. Soil derived from weathering of the unit predominantly consists of lean clay (CL).

Franciscan Mélange (KJfm). The mélange was described by Hall (1979) and Dibblee and Minch (2006) as pervasively sheared, greenish-black to dark gray claystone with exotic blocks that typically consist of graywacke[2], blueschist[3], metavolcanic rocks, chert, and serpentinite. These blocks can range from fractions of an inch to thousands of feet in size and are relatively resistant to weathering. Hall et al. (1979) noted the original structure of the mélange has been destroyed by shearing and mixing. Soil derived from weathering of the unit predominantly consists of lean clay (CL). The Franciscan Mélange is commonly associated with expansive soil, creep, slope instability and landsliding.

Serpentinite (sp). Hall (1979) described the serpentinite as locally serpentinized[4] ultramafic rocks. Serpentinite is a rock type composed of hydrothermally altered ultramafic minerals, and commonly contains naturally occurring asbestos (NOA).

4. FLOODING, EROSION AND SEDIMENTATION

Yeh reviewed the potential for flooding, erosion, and slope instability and landslides that may result in deposition of sediment (i.e., sedimentation) within the Avila URL. The potential for flooding, erosion and sedimentation was evaluated based on FEMA flood mapping, the USGS Coastal Storm Modeling System (CoSMoS) study, reports of historic storm damage, and Natural Resources Conservation Service (NRCS) maps. The potential for slope instability and landslides

[2] Graywacke is a sedimentary rock characterized by poorly sorted angular grains of sand to gravel sized particles with a matrix of clay minerals. It is commonly formed by submarine landslides.
[3] Blueschist is a metamorphosed ultramafic rock typically associated with low temperature, high pressure metamorphic conditions (e.g. shallow subduction zone).
[4] Serpentinization is a metamorphic process whereby minerals within a rock (usually ultramafic) are altered by a change in heat and pressure, and the addition of water. Typically, the minerals olivine and pyroxene alter to the mineral serpentine.

was evaluated based on a review of geologic maps, reports of historic landsliding, and County of SLO (2020a) landslide risk maps.

4.1 FLOODING

Flooding along waterways typically occurs as a result of excessive rainfall or snowmelt that creates water flows exceeding the capacity of channels. Flooding along shorelines is usually a result of coastal storms that generate storm surges or waves above normal tidal fluctuations. Development that increases impervious surface areas and off-site water conveyance can increase the frequency and severity of flooding.

Potential flood impacts include accelerated erosion of stream channels and shorelines, scour of structure foundations within the flood zone, and sedimentation by floodwaters or wave action. Infrastructure such as culverts, storm drains, and pipelines within the flood zone can be obstructed by debris accumulation or buoyed by floodwaters, resulting in additional damage. Flooding can also inundate treatment plants, contaminate water supplies, damage agricultural resources, and prevent the safe passage of people and flood-fighting resources. Sedimentation in a stream channel can reduce the flood capacity of the channel.

Figure 2 shows the FEMA (2020) 100-year and 500-year flood zones mapped in the vicinity of the Avila URL. Low-lying areas along See Canyon Creek, San Luis Obispo Creek, and along San Luis Bay are within the FEMA 100-year flood zone (1-percent annual chance of flood). The western half of the town of Avila is mapped within the 500-year flood hazard zone (0.2-percent annual chance of flood) at elevations of approximately 16 feet or lower (NAVD88). The 500-year flood hazard zone boundary is approximately 100 feet east of and parallel to San Miguel Street.

Figure 2: FEMA Flood Map; no scale

4.1.1 Historic Flooding and Storm Damage

Critical infrastructure within the Avila URL, such as the roads, parking, and public facilities have historically flooded. Sections of Avila Beach Drive, San Luis Bay Drive, and Ontario Road reportedly flood every 25 years or less. The Avila Beach public parking lot floods consistently during the rainy season and the County Public Works Department pumped the parking lot in 2016 (County of SLO 2018).

The County of SLO (2019b) reported that the wastewater treatment plant was inundated by floods in January and February 1969. Housing developments in the area experienced landslide activity as well as cracking of foundations and roads. Additionally, flooding damage occurred near the town of Avila during January and March 1995 storms, when high flow and debris blockages caused extensive damage to several bridges across San Luis Obispo Creek.

Historic storms have resulted in coastal flooding and storm waves that have damaged coastal structures. An approximately 100-foot section of the Avila Beach Pier was destroyed during a February 1960 storm. High tides and severe storm waves during the El Niño storm in March

1983 damaged the concrete seawall that runs parallel to Front Street and damaged development within the community of Avila Beach. The Union Oil Pier, Avila Beach Pier and portions of Avila Beach Drive were also severely damaged (County of SLO 2018).

4.2 Erosion

Yeh evaluated the potential for two predominant types of erosion: surface runoff erosion (i.e., sheet and rill erosion) and coastal erosion. Runoff erosion consists of the removal of soil from the land surface by the action of rainfall and runoff. Coastal erosion consists of beach sand removal and coastal bluff retreat by wave action and sea level rise.

4.2.1 Surface Runoff Erosion

Plate 4 shows erodibility factors (K) mapped by the NRCS. The erodibility factor indicates the susceptibility of a soil to sheet and rill by erosion by water. Values of K generally range from 0.02 to 0.69; however, the K value of soils mapped within the Avila URL range from 0.02 to 0.37. The higher the K value, the more susceptible the soil is to surface runoff erosion. There are areas within the Avila URL that have not been rated by NRCS. The NRCS (2020) map is intended to be used as a general guide for land use planning purposes only. It should not be considered as a substitute for performing appropriate drainage and erosion studies, or a substitute for providing proper site design and engineering of individual projects.

NRCS estimated K values of 0.2 or greater for the silty sand (SM) and lean clay (CL) mapped within the URL. Silty sand (SM) is mapped as a predominant soil type derived from weathering of the Squire, Belleview, and Gregg members of the Pismo Formation. Lean clay (CL) is mapped as the predominant soil comprising the alluvium near the confluence of San Luis Obispo Creek and See Canyon Creek, and as a predominant soil type derived from weathering of the Squire Member of the Pismo Formation, the Unnamed Sedimentary Rocks/Atascadero Formation, the Franciscan Metavolcanics, and the Franciscan Mélange.

Figure 3: Sedimentation Photos

Eroded sediment in V-ditch on Lupine Canyon Road (left); talus in catchment along Avila Beach Road (right)

We observed evidence of erosion consisting of sediment and talus[5] cones accumulating on and along the edge of roadways, including within v-ditches and catchments (see Figure 3). The sediment we observed typically consisted of silty sand (SM) and silty gravel (GM) derived from the Squire and Belleview Members of the Pismo Formation and the Monterey Shale. We also observed evidence of erosion along See Canyon Road consisting of a reduced roadway shoulder that likely resulted from bank erosion and incision along See Canyon Creek (see Figure 4).

[5] Talus is an outward sloping and accumulated heap or mass of rock fragments of any size or shape derived from and lying at the base of a rocky slope, and formed chiefly by gravitational falling, rolling, or sliding.

Figure 4: Eroded Roadway Shoulder on See Canyon Road

Historic Surface Runoff Erosion. We understand based on discussions with the County Public Works Department (2020b) that County forces have performed about 400 storm damage repairs on Avila Beach Drive since 2005. We understand those storm damage events predominantly consisted of roadway debris and obstructed drainage infrastructure resulting from erosion and surficial slope instability along the road. Additionally, the County (2020c) reported historic localized flooding along Colony Lane and First Street due to an obstructed culvert.

4.2.2 Coastal Erosion

Coastal erosion is typically caused by wind and wave action associated with storm surges or waves above normal tidal fluctuations. Coastal erosion occurs episodically, typically during large storms and periods of intense wave action that coincide with high tides. Waves erode the coastline at varying rates, depending upon the geology and wave energy. Coastal structures such as piers and onshore structures built near the edge of bluffs can be impacted by bluff retreat due to wave action. Erosion of beach sand removes the natural barrier which protects landforms, such as bluffs, and manmade structures from the potentially destructive wave action. Artificial shoreline barriers such as seawalls and rock revetment can also modify natural depositional environments and adversely affect shorelines.

Although most of Avila Beach is protected by 10 to 20-foot-high seawalls and rock revetment along Port San Luis and Front Street (see Figure 5), low-lying areas are potentially exposed to wave run-up and flooding. Avila Beach is partially sheltered from northerly swells by the Point San Luis Breakwater but is vulnerable to coastal storms originating from the southwest (County of SLO 2019b).

Figure 5: Rock Revetment along Avila Beach

The Coastal Storm Modeling System (CoSMoS) is a dynamic modeling approach that has been developed by the United States Geological Survey (USGS 2020, Barnard et al. 2018) in order to allow more detailed predictions of coastal flooding due to both future sea-level rise and storms integrated with long-term coastal evolution (i.e., beach changes and cliff/bluff retreat) over large geographic areas (100s of kilometers). Rather than relying on historic storm records, CoSMoS uses wind and pressure from global climate models to project coastal storms under changing climatic conditions during the 21st century. Rising sea levels will drive shorelines farther inland and beaches could be completely lost over the next century as the beaches are squeezed between the rising seas and bluffs or urban infrastructure (Barnard 2019). The CoSMoS cliff retreat projections consider two scenarios: 1) one that ignores coastal armoring, such as seawalls and revetments, and allows the cliff to retreat unimpeded (“Do Not Hold the Line”); and 2) another that assumes that current coastal armoring will be maintained and 100% effective at stopping future cliff erosion ("Hold the Line"). The CoSMos tool is intended to provide users with more information to manage and meet their own planning horizons and specify degrees of risk tolerance (Barnard et al. 2018).

Historic Coastal Erosion. As noted above, historic storms have shown that structures in both Port San Luis and Avila Beach are susceptible to damage resulting from storm waves, especially those generated from southerly swells (County of SLO 2018). The County of SLO (1999) reported the Unocal oil storage tanks formerly located at Avila Point were “endangered by cliff erosion” before the tanks were removed.

4.3 Slope Instability and Landslides

The down-slope movement of earth material, either as a landslide, debris flow, mudslide, or rockfall, are part of the continuous, natural process of erosion. Landslides and slope instability can occur as a result of erosion at the toe of a slope by a stream or wave action, wet weather, weak soils, improper grading, improper drainage, slopes oversteepened by grading, adverse geologic structure, ground shaking caused by earthquakes, or a combination of these factors. Proposed improvements on slopes can increase the potential for slope instability. Slope instability can occur in the form of creep, slumps, progressive translation or rotational failures, rockfall, debris flows, or erosion. Slope movement can result in permanent changes to topography and drainage patterns, such as the temporary damming of drainages and associated flooding, erosion, and sedimentation. (County of SLO 1999).

Figure 6 shows the County of SLO’s (2020a) map of landslide risk within the Avila URL. The potential for landslide risk predominantly ranges from low to high, according to the County’s rating system, which is predominantly rated based on existing slope grades and mapped geology. The County of SLO’s (2020a) map is intended to be used as a general guide for land use planning purposes only. It should not be considered as a substitute for performing appropriate geologic and geotechnical investigations, or a substitute for providing proper site design and engineering of individual projects. The potential for landslides was rated “very high” in the areas mapped as Quaternary landslides by published geologic maps (Hall 1979, Wiegers 2011) at Pirate’s Cove near Cave Landing Road and at the Harbor Terrace Development.

Historic Landslides. Following a period of heavy precipitation in December 1996 and January 1997, numerous landslides consisting of shallow earth flows, debris flows, and slumps occurred in the Irish Hills between the DCPP and Avila Beach. Debris from two landslides that occurred along Avila Beach Road temporarily blocked the road and access to the DCPP (PG&E 1997). Yeh and Associates (2019) identified nine landslides (historic and pre-historic) within the limits of the Harbor Terrace development. We understand landslide hazards have been identified by

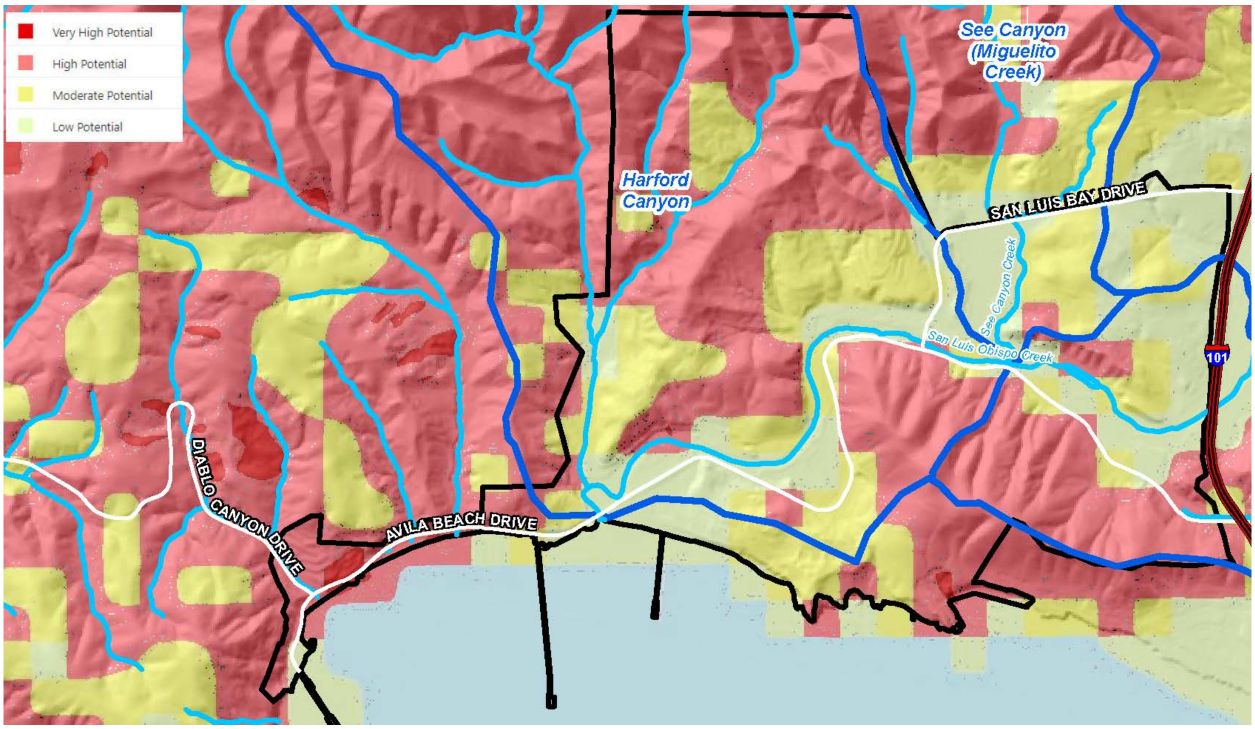

Figure 6: Landslide Risk Map (County of SLO 2020a); no scale

previous studies in the San Luis Bay Estates development and Pirates Cove recreational area; however, those studies were not reviewed for this study.

5. Preliminary Geotechnical Considerations

The following preliminary geotechnical considerations consist of typical design measures to mitigate potential adverse drainage, erosion and sedimentation impacts from increased surface runoff associated with grading for projects within the URL. Slope instability and landslides are also common sources of sedimentation, as displaced soil and rock masses typically consist of relatively loose and erodible material that can temporarily block or alter drainages and adversely impact adjacent improvements.

Sections 19.12/22.52/23.05.020 et seq. of the San Luis Obispo County Land Use Ordinance and Coastal Zone Land Use Ordinance, Titles 19, 22, and 23 of the County Code, contain the County's grading ordinance. This ordinance outlines specific requirements for grading permits, procedures for reviewing and approving grading permits, inspection requirements for completed grading projects, and erosion and drainage requirements.

5.1 Drainage and Erosion

The County of SLO's (2017) *Post Construction Requirements Handbook* provides guidance and direction on how to comply with post-construction stormwater requirements within San Luis Obispo County. Land Use Ordinance Section 22.52.110 and Coastal Zone Land Use Ordinance Section 23.05.040 et seq. require that the control of drainage and drainage facilities minimize harmful effects of stormwater runoff and resulting inundation and erosion on proposed projects, and protect neighboring and downstream properties from drainage problems resulting from new development (County of SLO 2017). Typical mitigation measures for drainage and erosion include providing:

- Drainage such that surface water does not run over slopes or pond on pavements, slabs, or adjacent to foundations in a concentrated flow;
- Downspouts to collect roof drainage and direct surface water to drainage pipes or areas away from foundation areas;
- Down drains, solid pipes, or lined ditches to carry water to the base of slopes.
- Energy dissipation and erosion control devices at the outlet of drainage devices and in areas of concentrated runoff to reduce the potential for erosion;
- Landscaping and maintenance of graded areas and slopes to assist the establishment of vegetation and reduce the potential for erosion; and
- Suitable vegetation, erosion control mats (where needed), and proper surface drainage to reduce the potential for erosion to impact slopes and assist in establishing suitable vegetation.

Landform grading is a technique to shape engineered slopes to more stable, naturally shaped slopes. Concave slopes allow water and vegetation to concentrate at flow lines. Grasses and groundcovers are planted on the convex portions of the slopes. Landform grading is intended to reduce erosion potential, runoff, and water quality degradation associated with grading (County of SLO 2017).

5.2 Slope Instability and Landslides

The County of SLO (2013) provides minimum standards for geologic and geotechnical studies prepared by a certified engineering geologist and/or geotechnical engineer to address slope stability and landslide hazards. Typical mitigation measures for slope instability and landslides include:

- Performing site specific evaluations to estimate the hazard potential and to identify engineering design methods to reduce the potential for slope instability and landslides;
- Addressing the potential for slope instability and landslides to impact improvements proposed on or adjacent to slopes, or adjacent to a beach or coastal bluff;
- Providing drainage improvements to collect and convey water away from slopes;
- Coordination between the civil engineer and the project engineering geologist and/or geotechnical engineer during design of graded slopes and drainage improvements, and continued coordination during construction;
- Grading cut and fill slopes to an inclination of 2h:1v or flatter. Slope stability analyses are typically performed for steeper slope inclinations. Fill slopes are typically steepened by using internal geosynthetic reinforcement, retaining walls, and/or select backfill; and
- Involvement of the project engineering geologist and/or geotechnical engineer during construction to confirm preliminary findings reported during initial studies.

Titles 22 and 23 of the County Code define general requirements for identifying Geologic Study Areas (GSA) that would require a geology report to address landslide hazards. The County of SLO's (2013) Guidelines for Engineering Geology Reports states that areas within urban reserve lines mapped as moderately high to high landslide risk, and areas "along the coast with bluffs and cliffs greater than 10 feet in vertical relief" are considered GSAs. As noted in Section 3, the Franciscan Mélange is a geologic unit commonly associated with creep, slope instability and landsliding. It is recommended that cut slopes in the Franciscan Mélange be designed by a certified engineering geologist and/or geotechnical engineer based on slope stability analyses. The cut slope design should be peer reviewed by the County of SLO reviewing geologist.

Section 23.04.118 of the Land Use Ordinance and the County of SLO (2013) provide methods to evaluate the potential for bluff retreat. It is recommended to consider the USGS (2020) CoSMoS tool in bluff retreat evaluations.

6. Limitations

Yeh prepared this report for Rincon Consultants and their authorized agents only. It is not intended to address issues or conditions pertinent to other parties, projects or for other uses. This report is for preliminary planning purposes only and is not intended for use in final design or construction. This study has been conducted in general accordance with currently accepted geotechnical practices in this area for use by the client for planning purposes. Any modifications to the recommendations of this report or approval of changes made to the project should not be considered valid unless they are made in writing.

7. References

Barnard, Patrick (2019), presentation titled "Climate change impacts to the Central Coast", United States Geological Survey, Pacific Coastal and Marine Science Center, Santa Cruz, CA; presented to the Central Coast Chapter of the American Public Works Association in September, 2019.

Barnard, P.L., Erikson, L.H., Foxgrover, A.C., Limber, P.L., O'Neill, A.C., and Vitousek, S. (2018), Coastal Storm Modeling System (CoSMoS) for Central California, v3.1: U.S. Geological Survey data release, https://doi.org/10.5066/P9NUO62B.

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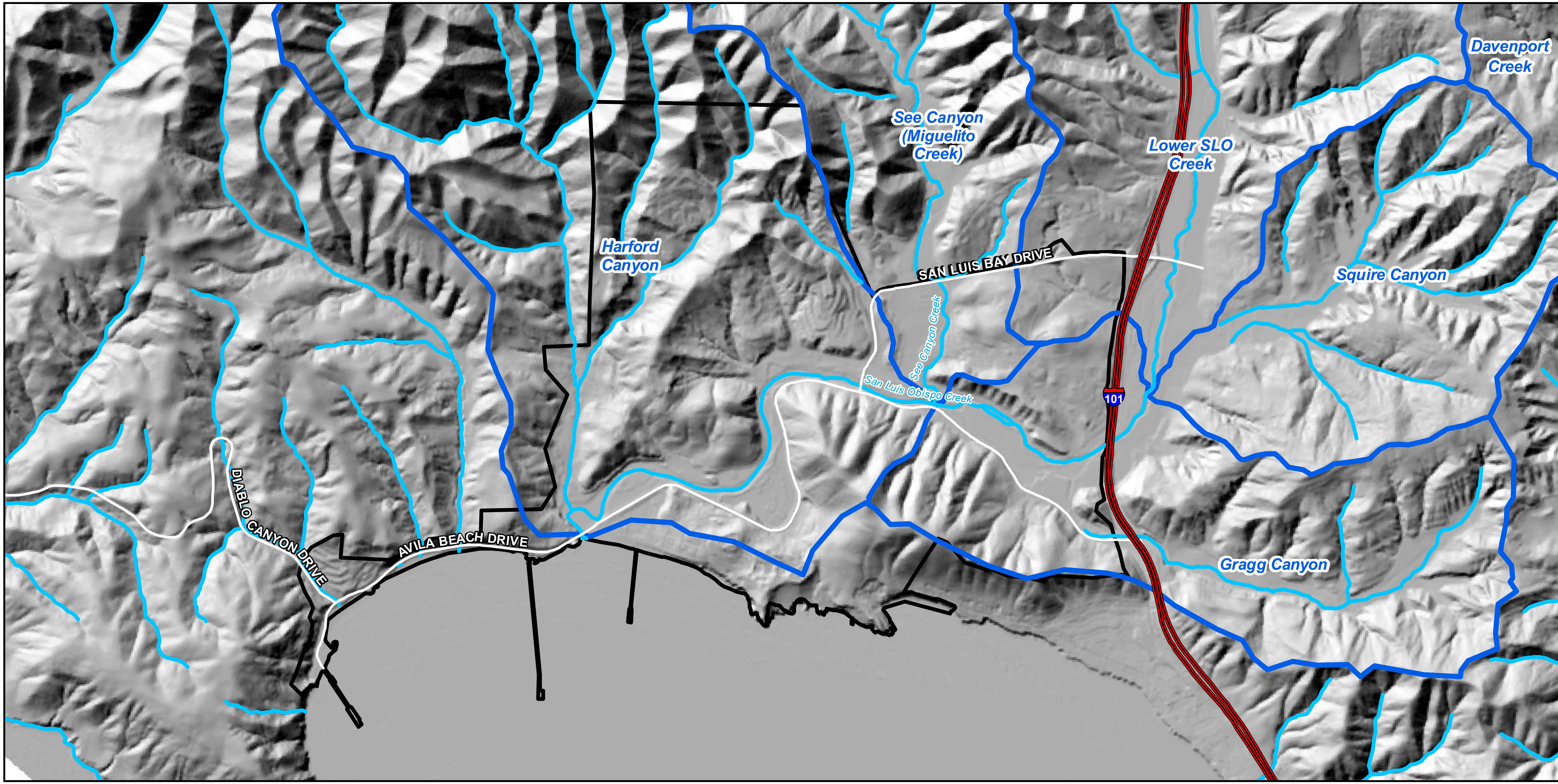

1 inch = 2,000 feet

0 2,000 Feet

Urban Reserve Line

Subwatersheds of the San Luis Obispo Watershed

Hillshade created from PG&E Diablo Canyon Power Plant Diablo Canyon (2010) and Los Osos (2011) Lidar datasets.
Streams shapefile from SLO Watershed Project, http://slowatershedproject.org/resources/
Subwatersheds delineated by Questa Engineering, 2019. Shapefiles received from San Luis Obispo County.

N

Avila URL Watersheds and Streams

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AVILA COMMUNITY PLAN
San Luis Obispo County, California

PLATE 1

Project Number: 218-514

Date: December 2020

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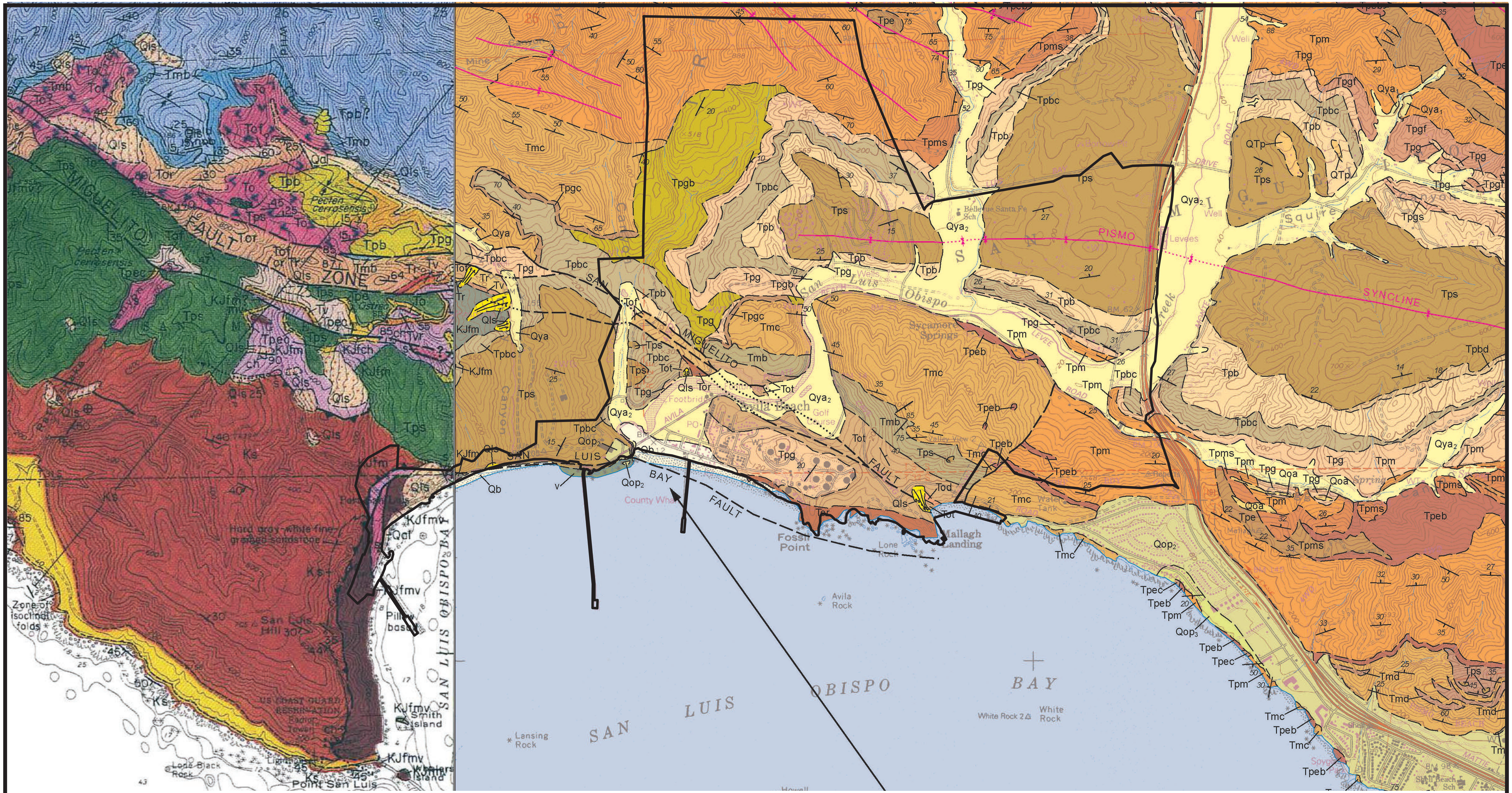


LEGEND:

Qya	Alluvium Deposits (Holocene)
Qls	Landslide Deposits (Holocene)
Tps	Pismo Formation, Squire Member (Pliocene to Miocene)
Tpb	Pismo Formation, Belleview Member - sandstone and siltstone (Pliocene to Miocene)
Tpbc	Pismo Formation, Belleview Member - claystone, siltstone, and sandstone (Pliocene to Miocene)
Tpg	Pismo Formation, Gregg Member - sandstone (Pliocene to Miocene)
Tpgb	Pismo Formation, Gregg Member - bituminous sandstone (Pliocene to Miocene)
Tpm	Pismo Formation, Miguelito Member (Pliocene to Miocene)
Tpeb	Pismo Formation, Edna Member - bituminous sandstone (Pliocene to Miocene)
Tmc	Monterey Shale - chert (Miocene)
Tmb	Monterey Shale - siltstone and dolomitic claystone (Miocene)
Tot	Obispo Formation - tuff (Miocene)
Tor	Obispo Formation - zeolitized tuff (Miocene)
Ks	Unnamed Sedimentary Rocks (Upper Cretaceous) - named Atascadero Formation [Kas] by Dibblee and Minch (2006)
KJfm	Franciscan Melange (Cretaceous to Jurassic)
KJfmv	Franciscan Metavolcanic Rocks (Cretaceous to Jurassic)
s	Serpentinite (Jurassic)

Base Map: Hall et al. (1979) Geologic Map of San Luis Obispo-San Simeon Region, California; Weigers (2011) Preliminary Geologic Map of Pismo Beach 7.5' Quadrangle, San Luis Obispo County, California

North

0 2000
feet

Yeh and Associates, Inc.
Consulting Engineers & Scientists

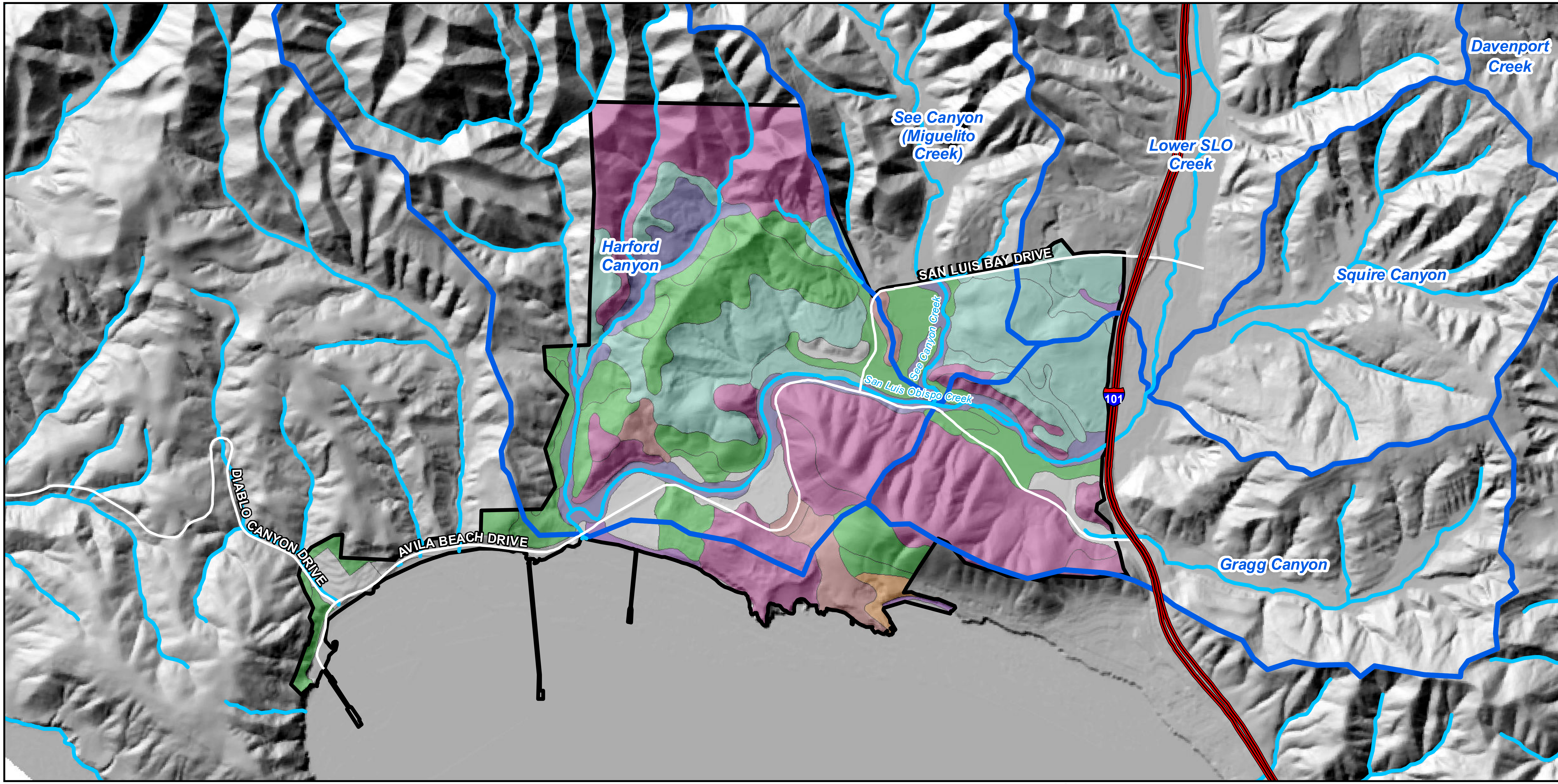
REGIONAL GEOLOGIC MAP

PROJECT NAME:
AVILA COMMUNITY PLAN
San Luis Obispo County, California

PROJECT NUMBER: 218-514

REVISION DATE: 11.12.2020

2



1 inch = 2,000 feet

0 2,000 Feet

Urban Reserve Line

Subwatersheds of the San Luis Obispo Watershed

USCS Soil Types

SP		SC		CL	
SM		ML		CH	
SC-SM		GM		Not rated or not available	

N

Soil information obtained from Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at the following link: http://websoilsurvey.sc.egov.usda.gov/. Accessed [10/13/2020].
Hillshade created from PG&E Diablo Canyon Power Plant Diablo Canyon (2010) and Los Osos (2011) Lidar datasets.
Streams shapefile from SLO Watershed Project, http://slowatershedproject.org/resources/
Subwatersheds delineated by Questa Engineering, 2019. Shapefiles received from San Luis Obispo County

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NRCS Soil Types

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San Luis Obispo County, California

PLATE
3

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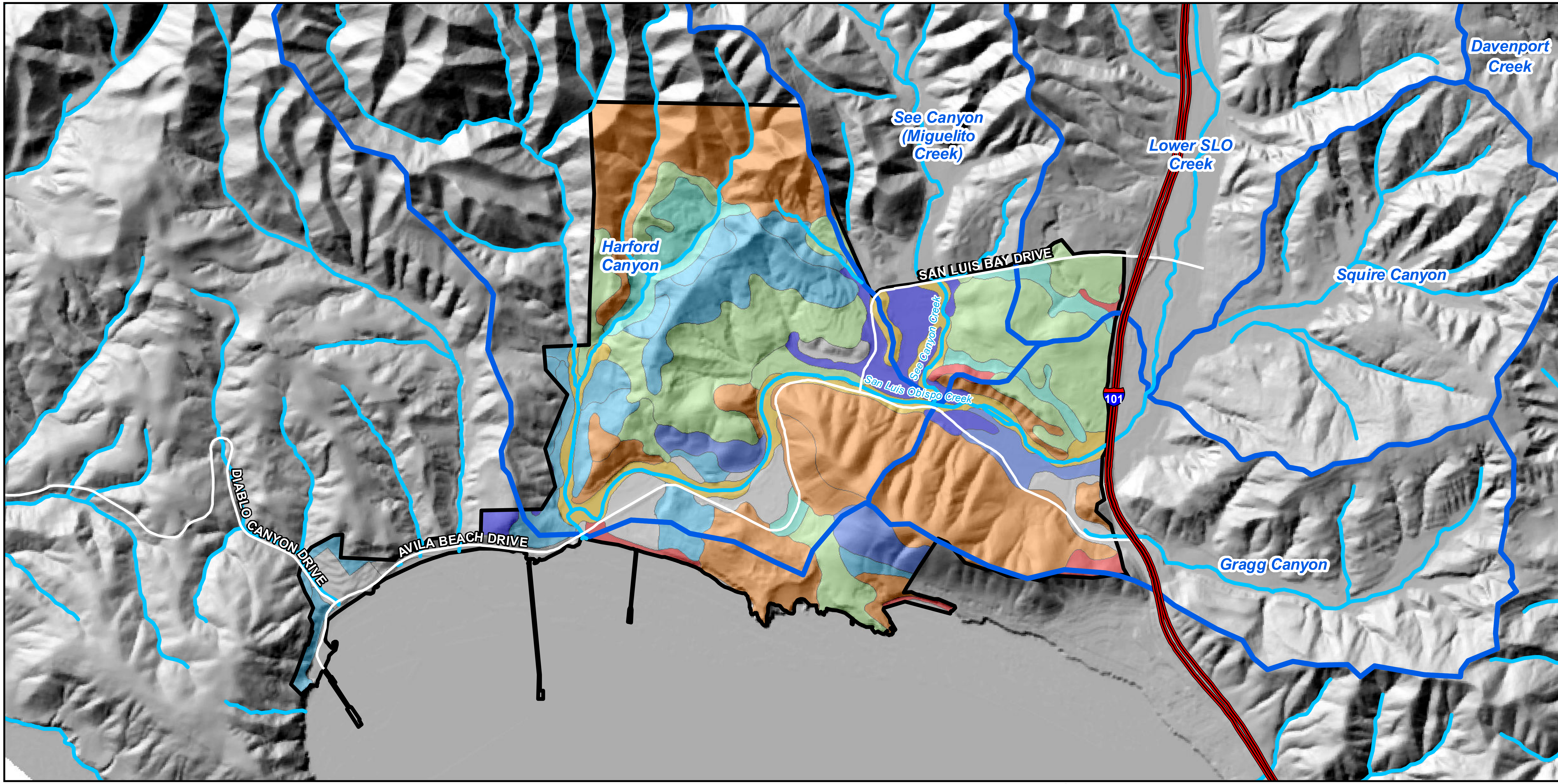

1 inch = 2,000 feet

0 2,000 Feet

Urban Reserve Line

Subwatersheds of the San Luis Obispo Watershed

Erodibility Factor (K)

.02
.05
.10
.15
.17
.20
.24
.28
.32
.37
Not rated or not available

Soil information obtained from Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at the following link: http://websoilsurvey.sc.egov.usda.gov/. Accessed [10/13/2020].
Hillshade created from PG&E Diablo Canyon Power Plant Diablo Canyon (2010) and Los Osos (2011) Lidar datasets.
Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.
Streams shapefile from SLO Watershed Project, http://slowatershedproject.org/resources/
Subwatersheds delineated by Questa Engineering, 2019. Shapefiles received from San Luis Obispo County

N

NRCS Erosion Factors

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San Luis Obispo County, California

PLATE 4

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